



U.S. APPLICATION NO (if known, see 37 CFR 1.5) <b>107089873</b>		INTERNATIONAL APPLICATION NO PCT/GB00/03799		ATTORNEY'S DOCKET NUMBER GJE-90	
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21. <input checked="" type="checkbox"/> The following fees are submitted: <b>BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):</b> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO. .... <b>\$1040.00</b> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ..... <b>\$890.00</b> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... <b>\$740.00</b> International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... <b>\$710.00</b> International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) ..... <b>\$100.00</b> <b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b>				<b>CALCULATIONS PTO USE ONLY</b>          <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:50%; text-align: right;">\$890.00</td> <td style="width:50%;"></td> </tr> </table>		\$890.00	
\$890.00							
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CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	\$			
Total claims	<u>12</u> - 20 =	<u>0</u>	x <b>\$18.00</b>	\$0.00			
Independent claims	<u>6</u> - 3 =	<u>3</u>	x <b>\$84.00</b>	\$252.00			
MULTIPLE DEPENDENT CLAIM(S) (if applicable)				+ <b>\$270.00</b>			
<b>TOTAL OF ABOVE CALCULATIONS =</b>				\$1,142.00			
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.				+			
<b>SUBTOTAL =</b>				\$1,142.00			
Processing fee of <b>\$130.00</b> for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).							
<b>TOTAL NATIONAL FEE =</b>				\$1,142.00			
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). <b>\$40.00</b> per property +							
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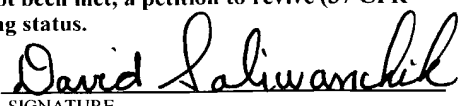
  

**NOTE:** Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR  
 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

CORRESPONDENCE ADDRESS:

**CUSTOMER NUMBER**  
**23,557**

April 3, 2002  
 DATE

  
 SIGNATURE  
 David R. Saliwanchik  
 NAME  
 31,794  
 REGISTRATION NUMBER

April 3, 2002

Patent Application  
Docket No. GJE-90

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants : Neill Rawson and Richard Lees  
Docket No. : GJE-90  
For : Nonwoven Abrasive Material

PRELIMINARY AMENDMENT

Please amend the above-identified patent application as follows:

In the Specification

Please add the following paragraph at page 1, above line 2:

This application is a National Stage Application of International Application  
Number PCT/GB00/03799, published, pursuant to PCT Article 21(2), in English.

After page 6: Please insert as new page 7 the attached Abstract of the Disclosure.

In the claims

The following amendments are made with respect to the claims in the international application PCT/GB00/03799 attached as Annexes to the International Preliminary Examination Report (IPER). Therefore, please replace existing page 8 of the international application with the amended claim sheet (replacement page 8) of the annex attached to the IPER, and make the following amendments to the pending claims so that they read as follows:

Please amend the following claims:

Claim 3 (amended):

The abrasive material according to claim 1, wherein the entanglement force between the said lengths is great enough to maintain a wad of the material when in use but small enough to allow the product to be shaped in the hand of a user.

Claim 4 (amended):

The abrasive material according to claim 1, which is deformable, and which able to maintain its shape when deformed.

Claim 5 (amended):

The abrasive material according to claim 1, having a strength sufficiently low enough to allow separation into user-defined quantities.

Claim 6 (amended):

The abrasive material according to claim 1, which has substantially the same tear strength in all directions.

Claim 7 (amended):

The abrasive material according to claim 1, wherein the abrasive is in the form of grains which are held in or on the fibers by a binder.



Remarks

Claims 3-8 and 11 have been amended and new claim 12 has been added. Accordingly, claims 1-12 are pending in the subject application. No new matter has been added by these amendments.

The Commissioner is hereby authorized to charge any fees under 37 CFR 1.16 or 1.17 as required by this paper to Deposit Account 19-0065.

Respectfully Submitted



David R. Saliwanchik

Patent Attorney

Registration No. 31,794

Phone No.: 352-375-8100

Address: Saliwanchik, Lloyd & Saliwanchik  
2421 N.W. 41<sup>st</sup> Street  
Suite A-1 Gainesville, FL 32606

DRS/la

Marked-up Version of Amended Claims

Claim 3 (amended):

[An] The abrasive material according to claim 1[ or claim 2], wherein the entanglement force between the said lengths is great enough to maintain a wad of the material when in use but small enough to allow the product to be shaped in the hand of a user.

Claim 4 (amended):

[An] The abrasive material according to [any preceding] claim 1, which is deformable, and which able to maintain its shape when deformed.

Claim 5 (amended):

[An] The abrasive material according to [any preceding] claim 1, having a strength sufficiently low enough to allow separation into user-defined quantities.

Claim 6 (amended):

[An] The abrasive material according to [any preceding] claim 1, which has substantially the same tear strength in all directions.

Claim 7 (amended):

[An] The abrasive material according to [any preceding] claim 1, wherein the abrasive is in the form of grains which are held in or on the fibers by a binder.

Claim 8 (amended):

A method of abrading a surface, which comprises contacting the surface with a wad of [an abrasive material according to claim,] an abrasive material comprising an integral mass of discrete lengths, substantially held together solely by entanglement forces, of abrasive-coated non-woven synthetic fibres, wherein the wad is obtainable from a larger mass of the material having a sufficiently low strength to allow it to be separated into the wad, of a desired quantity, and a sufficiently high strength to maintain the wad of material when in use.

Claim 11 (amended):

An abrasive material obtainable by a method [according to claim 9 or claim 10] comprising the steps of:

- (i) spraying a nonwoven synthetic fibre fleece with resin and binder;
- (ii) spreading the sprayed fleece with abrasive;
- (iii) curing the binder; and
- (iv) passing the resultant material to a fibre-opening machine to wholly or substantially separate the fibres from one another.



Abstract of the Disclosure

An abrasive material comprises an integral mass of discrete lengths, not bonded to each other, of abrasive-coated non-woven synthetic fibres. In particular, the entanglement force between the said lengths is great enough to maintain a wad of the material when in use but small enough to allow the product to be shaped in the hand of a user.

**NONWOVEN ABRASIVE MATERIAL**Field of the Invention

This invention relates to nonwoven abrasive materials.

Background to the Invention

5 Nonwoven abrasive materials are well known in the art. Many of these articles are manufactured from polyamide fibres, and include a binder such as phenol-formaldehyde (PF) resin. There are currently a large number of non woven abrasive products in the market place. Most of these articles are made from polyamide fibres (generally Nylon 6 or Nylon 66) and the binder usually employed is phenol-  
10 formaldehyde resin (PF). For less aggressive products, polyester fibres and acrylic binders are often used. Current nonwoven abrasives are used in sheets, pads or discs, or are converted into flap wheels or bias mops etc., all of which require sheet strength and integrity. All have sufficient integrity to exist in the form of a sheet having defined surfaces that retains its shape when used for surface-finishing and cleaning.

15 Products that do not have such integrity and that may be used for surface cleaning and preparation are typically made of cotton wool or steel wool. These materials differ from nonwoven abrasives in that they contain no mineral abrasive particles and in that the fibres are wholly or substantially natural in the case of cotton wool or metallic in the case of wire wool. In both cases, surface cleaning and  
20 preparation are effected by the fibres themselves. In the case of nonwoven abrasives, the surface cleaning and preparation is mostly or entirely a result of the abrasive action of the abrasive mineral grains and/or the binder system contained within the structure. The synthetic fibres are used largely as carriers for these abrasive grains and binders.

25 Summary of the Invention

According to a first aspect of the present invention, an abrasive material comprises nonwoven synthetic fibres obtained by breaking down a larger mass of fibres into small individual sections with no bonding between them. These sections may be individual fibres, a number of fibres bound together or thin strips of nonwoven  
30 fleece.

According to a second aspect of the present invention, an abrasive material comprises nonwoven, synthetic fibres, wherein the entanglement force between the fibres is great enough to maintain a wad of material when in use but small enough to allow the product to be shaped in the hand of a user.

According to further aspects of the present invention, an abrasive material comprises nonwoven, synthetic fibres, and can be separated in user-defined quantities and/or does not have a planar surface.

According to another aspect of the present invention, a method of manufacturing an abrasive material comprises the steps of:

- (i) spraying a nonwoven synthetic fibre fleece with resin and binder;
- (ii) spreading the sprayed fleece with abrasive;
- (iii) curing the resin; and
- (iv) passing the resultant material to a fibre-opening machine to wholly or substantially separate the individual fibres from one another.

An alternative to step (iv) comprises shredding the material produced in step (iii).

A material of the present invention is useful in a number of applications, for example, where a highly deformable abrasive material is required.

Advantageously, by contrast to known nonwoven and coated abrasive materials, the novel abrasive material has a low enough tear strength to allow it to be separated into a smaller wad and a high enough tear strength to maintain its integrity as a wad or deformed wad when in use.

By contrast to steel wool, a material of the invention is highly abrasive but much less aggressive to the hand. Another advantage is that it is non-rusting. Another advantage is that it is not as highly flammable as steel wool.

#### Description of the Invention

A nonwoven abrasive material of the present invention may be manufactured from components typically found in conventional nonwoven materials. Nevertheless, it has a number of physical characteristics and properties that differ from known materials.

In particular, the novel material comprises synthetic fibres coated with binder and abrasive grain, that are wholly or substantially not bonded to one another. The entanglement force between these fibres is great enough to maintain a wad of material when in use but small enough to allow the product to be shaped in the hand of the user.

The material may be torn apart, in wads, and also shaped, or "crumpled", into a desired form. The product typically does not have a planar surface and, unlike conventional products, cannot easily be converted back to its original form.

The ease with which the material may be torn apart and, in particular, that there is no "directional influence" on the tearing, means that the material may be separated in user-defined quantities. By "no directional influence" is meant that there is no difference in the force required to tear one part of the product from that required to tear any other part. This is a significant improvement, as conventional materials are typically provided in manufacturer-defined quantities.

It will be appreciated that criteria given for the integral strength of a product of the invention may depend on the particular user. It will nevertheless be understood that these criteria are meaningful, for example since the ability to separate a part of the larger mass, to form a wad, without destroying the remainder, is a characteristic of, say, cotton wool. Similarly, it will be evident whether or not a product can or cannot maintain its shape when crumpled.

A preferred process for the production of a nonwoven, synthetic, abrasive material comprises the steps of:

- (i) separating and blending fibres;
- (ii) carding and cross laying the fibres to form a fleece;
- (iii) spraying the resulting fleece with a slurry containing abrasive grain and binder;
- (iv) optionally spreading the sprayed fleece with abrasive grain;
- (v) drying and curing the binder in an oven; and
- (vi) passing the resultant material to a fibre-opening machine to wholly or substantially separate individual fibres (or groups of fibres) from one another.

A preferred fibre-opening machine is a wilying machine. Other machines having essentially the same effect will be known to those in the art.

An alternative to step (vi) is shredding the cured material, to produce thin strips of material, e.g. between 2 and 10 mm wide.

It will be evident to one of ordinary skill in the art that alternative methods of preparing nonwoven abrasive material are known. For example, air laying may be used, instead of carding.

The abrasive material is typically constructed from three elements, e.g. using the above described process. The fibres are suitably Nylon 66 or polyester. It will be understood that any synthetic fibres may be used, dependent upon the desired use of the product and the binder system employed. Preferably, the fibre density is

between 5 and 200 dtex. Combinations thereof may be used, dependent upon process and product performance requirements. The fibres typically have a staple length of 60 mm. It will be understood that this may vary dependent on product performance and process requirements.

5           The binder is typically an aqueous PF resin in combination with PA66 fibres, or an acrylic binder in combination with polyester fibres. Again dependent upon product application and process requirements, any binder system may be employed, for example epoxy resins, styrene-butadiene resins or polyurethane.

10           The abrasive grains are preferably of aluminium oxide or silicon carbide. It is understood that other abrasives could be used such as Emery, dependent upon the desired performance characteristics of the product. The size of abrasive grains used is typically between #30 and #1800 grit.

15           Mineral fillers such as fused alumina silicate may also be used. The size and also the chosen type depending on the process and performance characteristics of the product.

          The following Examples illustrate the invention.

#### Example 1

20           Staple fibres of 17 dtex Nylon 66 of staple length of 60 mm are opened using a wilying machine and 2 disc openers and transported by air to a card. The fibres are then processed through the card to produce a unidirectional fleece. The fleece is then passed to a cross-lapper, to build up layers of fleece to form a batt of fibre weight 30 g/m<sup>2</sup>.

25           The fibre batt is sprayed with an aqueous phenol formaldehyde (PF) resin and mineral filler slurry. The components making up the slurry are added together to give a total mix weight of about 800 kg. This is continuously agitated to prevent the contents from settling. The weight ratio of dried resin to filler is 1:3. The slurry also includes a small percentage (<1%wt) of a pigment. Prior to spraying, the slurry solids content is approximately 65%wt. A total of 92 g/m<sup>2</sup> is sprayed onto the batt.

30           #180 Aluminium oxide is then spread on the surface of the batt to a density of 80 g/m<sup>2</sup>, to produce an abrasive fleece. The resulting fleece is then passed through a forced air drier to dry and cure the resin. The finished weight is 170 g/m<sup>2</sup>. At this point, the fibres contained within the fleece are bound together with PF resin.

The fleece is then passed through a fibre opening (wilying) machine where the bonds between the fibres are wholly or substantially broken. The resulting resin and abrasive coated fibres are then air-transported to a fibre collection bin.

Examples 2 and 3

Two further abrasive products were made, using the same fibres, binder and procedure as Example 1. The other characteristics of the Examples are tabulated below.

10	1st Abrasive grain type size	Mineral Filler	Fibre:Binder Ratio	Fibre:1st abrasive grain ratio	Fibre:Mineral filler ratio
	Aluminium oxide #180	Fused Alumina silicate	2:1	1:2.7	1:0.7
	Aluminium oxide #320	Fused Alumina silicate	2:1	1:1.3	1:0.7
15	Aluminium oxide #600	None	1.9:1	1:1.5	0

CLAIMS

1. An abrasive material comprising an integral mass of discrete lengths, not bonded to each other, of abrasive-coated non-woven synthetic fibres.
2. An abrasive material according to claim 1, wherein the lengths are each of individual fibres, a number of fibres bound together or thin strips of nonwoven fleece.
3. An abrasive material according to claim 1 or claim 2, wherein the entanglement force between the said lengths is great enough to maintain a wad of the material when in use but small enough to allow the product to be shaped in the hand of a user.
4. An abrasive material according to any preceding claim, which is deformable, and which is able to maintain its shape when deformed.
5. An abrasive material according to any preceding claim, which can be separated in user-defined quantities.
6. An abrasive material according to any preceding claim, which has substantially the same tear strength in all directions.
7. An abrasive material according to any preceding claim, wherein the abrasive is in the form of grains which are held in or on the fibres by a binder.
8. A method of abrading a surface, which comprises contacting the surface with a wad of an abrasive material according to any preceding claim, wherein the wad is obtainable from a larger mass of the material having a sufficiently low strength to allow it to be separated into the wad, of a desired quantity, and a sufficiently high strength to maintain the wad of material when in use.
9. A method of manufacturing an abrasive material, comprising the steps of:
  - (i) spraying a nonwoven synthetic fibre fleece with resin and binder;
  - (ii) spreading the sprayed fleece with abrasive;
  - (iii) curing the resin; and
  - (iv) passing the resultant material to a fibre-opening machine to wholly or substantially separate the fibres from one another.
10. A method of manufacturing an abrasive material, comprising the steps of:
  - (i) spraying a nonwoven synthetic fibre fleece with resin and binder;
  - (ii) spreading the sprayed fleece with abrasive;
  - (iii) curing the resin; and
  - (iv) shredding the resultant material to produce thin strips of material.
11. An abrasive material obtainable by a method according to claim 9 or claim 10.

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Lane, Greetland, Halifax, P.O. Box 3, West Yorkshire HX4  
8NJ (GB).

(21) International Application Number: PCT/GB00/03799

(74) Agent: GILL JENNINGS & EVERY; Broadgate House,  
7 Eldon Street, London EC2M 7LH (GB).

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(71) Applicant (*for all designated States except US*):  
**FREUDENBERG LTD.** [GB/GB]; Ellistones Lane,  
Greetland, Halifax, P.O. Box 3, West Yorkshire HX4 8NJ  
(GB).

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(72) Inventors; and

(75) Inventors/Applicants (*for US only*): **LEES, Richard**  
[GB/GB]; Freudenberg Ltd., Ellistones Lane, Greetland,  
Halifax, P.O. Box 3, West Yorkshire HX4 8NJ (GB).  
**RAWSON, Neill** [GB/GB]; Freudenberg Ltd., Ellistones

For two-letter codes and other abbreviations, refer to the "Guid-  
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(54) Title: NONWOVEN ABRASIVE MATERIAL

(57) Abstract: An abrasive material comprises an integral mass of discrete lengths, not bonded to each other, of abrasive-coated non-woven synthetic fibres. In particular, the entanglement force between the said lengths is great enough to maintain a wad of the material when in use but small enough to allow the product to be shaped in the hand of a user.

WO 01/24970 A1



USA

DECLARATION AND POWER OF ATTORNEY

As a below-named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name; I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of subject matter which is claimed and for which a patent is sought on an invention entitled  
**NONWOVEN ABRASIVE MATERIAL**

the specification of which ☐ is attached hereto or

☐ was filed on 04 OCT 2000 as United States Application Number or PCT International Application Number PCT/GB00/03799 and was amended on (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56. I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for a patent or inventor's certificate, or PCT international application having a filing date before that of the application on which priority is claimed:

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As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:  
Saliwanchik, Lloyd & Saliwanchik  
2421 N.W. 41st Street, Suite A-1  
Gainesville, FL 32606-6669  
USA

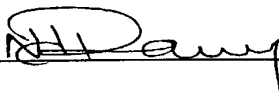
Direct all correspondence to:

David R. Saliwanchik, Reg. 31,794; Jeff Lloyd, Reg. 35,589; Doran R. Pace, Reg. 38,261; Christine Q. McLeod, Reg. 36,213; Jay M. Sanders, Reg. 39,355; James S. Parker, Reg. 40,119; Jean E. Kyle, Reg. 36,987; Frank C. Eisenschenk, Reg. 45,332; Seth M. Blum, Reg. 45,489; Glenn P. Ladwig, Reg. 46,853; Margaret Efron, Reg. 47,545 and Jon Michael Gibbs, Reg. 47,594

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Full name of sole or First Inventor Neill RAWSON

Inventor's signature



Residence address Halifax, United Kingdom GBX

Post Office address

SIA FIBRAL LTD., P.O. Box 3, Ellistones Lane, Greetland  
Halifax HX4 8NJ, United Kingdom

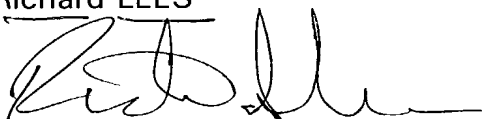
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Date of signature 22/03/02

Full name of Second Inventor

Richard LEES

Inventor's signature



Residence address Halifax, United Kingdom GBX

Post Office address

SIA FIBRAL LTD., P.O. Box 3, Ellistones Lane, Greetland  
Halifax HX4 8NJ, United Kingdom

Country of Citizenship United Kingdom

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